

CenEA Working Paper Series WP02/16

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Abstract: We examine the dynamics of disposable incomes and their specific components in Poland between 2005 and 2014 using data from the Polish Household Budget Surveys. We focus in particular on changes in the distribution of earnings and pensions and examine why at the time of rapid economic growth which Poland experienced at the time income inequality has remained relatively stable. Fiscal reforms implemented during this period are analysed from the point of view of the changing distributional implications of the tax and benefit system. Finally, we decompose changes in inequality of disposable incomes to identify the role of tax and benefit policies and separate it from other factors affecting incomes at the time. We find that 44% of the 0.7pp reduction in the Gini coefficient between 2005-2014 can be associated with tax and benefit reforms.

1 Introduction

There has been growing evidence that avoiding high levels of income inequality may be positively related to long-term economic performance and that increases in inequality may be harmful to economic prospects (Cingano, 2014; Kumhof and Rancière, 2010). The channels through which inequality might affect growth range from most immediate issues related to the relationship between income and consumption to more complex channels via the quality of public services, intergenerational mobility and equality of opportunity. Inequality is also strongly related to the level of crime, to social or political involvement and various measures of social capital. From this perspective there is a number of important questions that arise when looking at the Polish experience in recent. In this paper we focus our analysis on the development in the distribution of household incomes in Poland between 2005 and 2014 to identify the most important drivers of incomes in recent years and to single out the role of government tax and benefit policy. Despite rapid economic development in the analysed period the level of income inequality in Poland – according to the official statistics – has changed very little. From 2006 till 2014, the Gini coefficient reported by GUS, the Polish

¹ This paper has been prepared as a background paper for the "Lessons Learnt from Poland" project financed by the World Bank. The analysis benefited from discussions with and comments from the World Bank team involved in the project. We are grateful in particular to Emilia Skrok, Gabriela Inchauste and Enrique Aldaz-Carrol.

Central Statistical Office, on the basis of data from the Polish Household Budgets Survey (PHBS) dropped slightly from 34.0 to 32.6. In the same period for the EUROSTAT EU-SILC data, the Gini coefficient changed from 33.3 to 30.8, though the inequality measures computed on the first year of EU-SILC data collection in Poland have often been questioned.

How income inequality changes is a reflection of consequences of various drivers of economic development as well as the institutional dimension which translate changes in the distribution of market incomes into disposable resources of households. To understand the dynamics of disposable incomes in recent years in Poland we examine the most important reasons behind the stability of income inequality. The analysis is based on data from the PHBS from 2005, 2008, 2011 and 2014 with a particular focus on the initial and the final year of the period. The paper is structured as follows. In Section 2 we document the importance of population weights which serve to gross-up the representative datasets to population totals. Depending on the type of grossing-up corrections both the level and the dynamics of inequality in the analysed period changes which underlines the importance of careful analysis of the representativeness of the data from the point of view of comparisons across time and between countries. In Section 3 we describe the changes in gross incomes - in particular the dynamics of employment and employment incomes and pensions. For this purpose we apply the method of DiNardo, Fortain and Lemieux (DiNardo et al., 1996) to show the effects on income distributions of changes in population characteristics, and in particular education levels, over the 2005-2014 period. Following this in Section 4 we discuss the role of tax and benefit policy in this period for the distribution of disposable incomes in Poland and the resulting inequality and poverty levels. We analyse changes in the degree of progressivity of the tax and benefit system and perform a decomposition analysis following Bargain and Callan (Bargain and Callan, 2010) to identify the relative role of fiscal policy. Section 5 concludes the paper.

2 Income inequality in the PHBS: the role of grossing-up weights and income definition

The Polish Household Budget Surveys (PHBS) provide a rich source of information on the demographic composition of households as well as their incomes and expenditures. However, a number of drawbacks has been identified recently which play an important role in distributional analysis with this data. As is the case with most, if not all, income and

expenditure surveys, the PHBS suffers from the problem of incomplete participation, and the consequent degree of non-randomness in the composition of the final sample. Although the collected samples are corrected for this potential source of bias through sample grossing-up weights, these weights take into account and correct only for the original data sample design probabilities and do not reflect the additional bias in survey participation given the characteristics of participating households.²

A illustrative example of the consequent problems related to non-random non-response can be made by comparing age distributions using weights provided with the PHBS data by the Statistical Office and the official age pyramids from administrative statistics. As we can see in Figure 1 the PHBS weights result in an overrepresentation of children aged 0-15 by about 0.7m in 2005 and by more than 1.4m in 2014, and in the corresponding underrepresentation of the adult population. Such discrepancies may result in inaccuracies with regard to the levels of child and old-age poverty, as well as to diverging values for income inequality levels and trends in how inequality changed over time.



Figure 1. Population age structure in 2005 and 2014: administrative and PHBS data

Source: (Główny Urząd Statystyczny, 2015a, 2006) and PHBS. *Notes:* Data for PHBS weighted with the original sample weights provided by the Central Statistical Office.

 $^{^2}$ In case of the PHBP, as described in (Główny Urząd Statystyczny, 2011) household weights are constructed to reflect the household size (up to households with 6+ persons) and the place of residence (urban/rural). In effect the selection probability is corrected to match these 12 characteristics and region (voivodship).

In Myck and Najsztub (2015) following Creedy (2004) and Deville and Sarndal (1992), we proposed specific procedures for calibrating raw survey sample weights using information from a number of administrative sources to correct the population weights in the PHBS. The reweighting method allows for adjustment of the weights in a way to "target" specific characteristics and ensure that in the grossed-up data they correspond to target values. The proposed procedures target different types of characteristics. The simplest level of reweighting targets the age distribution in the PHBS sample, while more advanced approaches extend the targets to cover such characteristics as employment or tax obligations. The corrected weights also address the problem of changes in population size due to migration.³

A separate issue which may have an influence on both the level and the dynamics of inequality is the precise definition of income. Since in the analysis below we focus on the implications of tax and benefit policy, the income concept we use differs slightly from the declared disposable income as collected in the PHBS data. The latter, due to the nature of the survey is (with some exceptions) defined as the sum of declared income sources in a given month. As a result it ignores a number of systemic factors which would have an influence on the level of average monthly income of a given household in the year of the data collection such as the nature of received payments or the progressivity of taxation. Moreover, due to time lags between assessment of eligibility and payment of means-tested benefits, declared incomes may not reflect the benefit system at the given time correctly. For these reasons in this paper we will focus on average monthly disposable income derived from specifically declared sources which results from a tax and benefit microsimulation procedure, with seasonal adjustments for income from agriculture. Incomes declared in the data are subject to a microsimulation adjustment using the SIMPL microsimulation model (Bargain et al., 2007; Morawski and Myck, 2011, 2010; Michal Myck et al., 2013). For comparability we also analyse poverty and inequality using the GUS derived income.

In Table 1 we present income poverty and inequality measures for our definition of disposable income using two different sets of grossing-up weights. The first set of figures uses the raw weights as provided by the statistical office (GUS), while the second adjusts these given the actual age structure of the population and a number of simulated elements of the tax and

³ It is estimated that the population of migrants staying abroad for more than 3 months was around 2.3m people, of which 1.9m were abroad for more than 12 months (Główny Urząd Statystyczny, 2015b).

benefit system for each year.⁴ Poverty rates and the Gini index have been calculated on household disposable per capita income. We use the 60% of median per capita household disposable income as the poverty line. We also introduce absolute poverty rates for 5 and 10 USD in 2005 PPP terms.⁵ As we can see both the dynamics of nominal median income and the computed poverty and inequality measures differ slightly for each of the two sets of weights. The median income in 2014 is 85% higher compared to 2005 when we use the raw weights and it is 78% higher with the calibrated weights. The choice of weights also has an influence on the calculated poverty levels and dynamics of poverty – in particular for the overall poverty headcount which falls by 1.2pp when we use the raw weights and grows by 0.3pp for calibrated weights. The pattern of poverty changes by age group on the other hand is largely preserved for both sets of weights. One very interesting feature of the dynamics of incomes between 2005 and 2014 is that while the level of child poverty fell by about 4.9pp (using simulated incomes), the poverty rate among those aged 65+ increased by nearly the same proportion. Overall the headcount poverty measure increased by 0.3pp, while the Gini index dropped by only 0.1pp.

| Table 1. Poverty ratios and inequality measured by the Gini coefficient for different weights and years | | | | | | |
|---|--------------------|---------|--------|--------|--|--|
| | 2005 | 2008 | 2011 | 2014 | | |
| Original grossing up weights | | | | | | |
| Median disposable income | 291.65 | 375.84 | 396.51 | 422.57 | | |
| Poverty line | 174.99 | 225.51 | 237.90 | 253.54 | | |
| Gini | 35.5 | 34.0 | 34.3 | 33.7 | | |
| Relative pov. | 21.0% | 19.4% | 19.9% | 20.7% | | |
| – less than 18 y.o. | 34.3% | 31.8% | 31.8% | 32.5% | | |
| - 65+ | 5.8% | 7.5% | 7.0% | 7.0% | | |
| Abs. pov.: 5\$ per day | 15.3% | 7.0% | 6.7% | 6.0% | | |
| Abs. pov.: 10\$ per day | 52.8% | 35.7% | 32.3% | 29.4% | | |
| Weights corrected for population st | ructure and income | sources | | | | |
| Median disposable income | 298.53 | 371.78 | 389.83 | 420.75 | | |
| Poverty line | 179.12 | 223.07 | 233.90 | 252.45 | | |
| Gini | 35.1 | 34.5 | 34.6 | 34.3 | | |
| Relative pov. | 20.7% | 19.6% | 20.0% | 20.6% | | |
| – less than 18 y.o. | 33.7% | 31.4% | 31.4% | 31.3% | | |
| - 65+ | 5.9% | 7.8% | 7.3% | 8.0% | | |
| Abs. pov.: 5\$ per day | 14.0% | 7.2% | 7.2% | 6.1% | | |
| Abs. pov.: 10\$ per day | 51.3% | 36.4% | 33.3% | 29.6% | | |

Note: Incomes in real 2005 PPP USD values. Poverty and inequality indexes calculated using GUS definition of

⁴ These elements include: the number of taxpayers, the number of Health Insurance contributors for permanent and self-employment, the total number of pensioners and the number of unemployment benefit recipients (for details see Myck and Najsztub, 2015).

⁵ A similar table for the simulated income can be found in the Appendix.

available per capita income on individual level. Negative incomes have been converted to 0 and included in Gini calculation.

3 Dynamics of gross incomes: employment, wages and inequality

In this section we examine the dynamics of one of the key drivers of income inequality, namely incomes from employment, to provide a background for the analysis of fiscal policy rules in Section 4.

Although from a technical point of view Poland was close to a recession in the end of 2012, in the sense that it recorded two subsequent quarters first with zero and second of negative growth in a row, the overall effect of the financial crisis and the economic slowdown after 2008 has been relatively mild. On the labour market the consequences of the diminished rate of growth have been reflected in reduced level of employment and higher unemployment right after 2008. However, by 2014 employment level has increased steadily approaching the rate recorded for 2008 (see Table 2). Looking at the years 2005-2014 the overall employment rate was 3.4pp higher at the end compared to the beginning of the period. Importantly there has been a substantial change in the employment pattern by age group: in 2014 employment among those below 26 was at a similar level compared to 2005, but for those aged 55-64 the rate increased from 30.0% to 37.9%, and employment among this group increased both among men and among women (see Figure 2).

| Table 2. Employment rates for the years 2005, 2008, 2011 and 2014 by age groups | | | | | |
|---|-------|-------|-------|-------|--|
| | 2005 | 2008 | 2011 | 2014 | |
| below 26 | 27.7% | 34.9% | 29.8% | 27.8% | |
| 26 - 44 | 76.5% | 80.4% | 76.6% | 77.2% | |
| 45 - 54 | 67.2% | 71.8% | 70.3% | 72.5% | |
| 55 - 64 | 30.0% | 32.3% | 33.0% | 37.9% | |
| Total | 54.9% | 59.1% | 56.6% | 58.3% | |

Note: Employment rates calculated for population aged 15 and older. Source: PHBS data, 2005, 2008, 2011, 2014. Calibrated weights.



Figure 2. Employment rates by age group and gender: 2005, 2008, 2011 and 2014

Notes and source: see Table 2.

3.1 Distributional changes of gross incomes: earnings and pensions

While employment level fluctuated in the analysed period there has been a steady growth of earnings between 2005 and 2014. Average nominal gross earnings between January 2005 and January 2015 increased by 64%, while the national gross minimum wage grew by as much as 106%. Given the cumulative level of CPI inflation over this time at 25%, this implies real changes in wages of respectively 31% and 64%. The dynamics of these two measures of wages are shown in Figure 3. The minimum wage increased substantially in particular in 2008 and 2009, and the rate of increase of the average wage was particularly strong in 2007 and 2008. At the same time the average pension, which on the one hand reflects the indexation of pensions by the government, and on the other the changing composition of pensioners, grew relatively steadily over the analysed period.

Figures 4 and 5 demonstrate more details of the earnings and pension dynamics by presenting how the overall distributions of nominal total labour cost and gross pensions, as observed in the PHBS, changed for years 2005, 2008, 2011 and 2014.⁶ Between 2005 and

⁶ Gross values of earnings and pensions are obtained by grossing-up of net values reported in the survey (for details see: Bargain et al., 2007).

2014 the mean value of gross earnings in the PHBS increased by 66%, and the growth was especially strong between 2005-2008 and 2008-2011 (respectively 24% and 23%), with much slower increase in the last three years of the analysed period (9%). This growth, when compared to the steady but much slower dynamics of pensions (Figure 5) can partly explain the reason behind growing old age poverty levels (Table 2). It is also important to notice that the distribution of gross earnings has become more equal between 2005 and 2014 with the individual level Gini coefficient falling from 41.9 to 38.4 (Table 3) while inequality of gross pensions largely remained unchanged.

| Table 3.Wages and pensions distribution: Gini coefficients, 2005, 2008,2011, 2014 | | | | | | |
|---|------|------|------|------|--|--|
| Gini coefficients: | 2005 | 2008 | 2011 | 2014 | | |
| Earnings (total labour cost) | 41.9 | 40.5 | 39.4 | 38.4 | | |
| Pensions | 26.8 | 27.4 | 27.5 | 26.5 | | |

Source: PHBS data, 2005, 2008, 2011, 2014.

Notes: Grossed-up net values using SIMPL microsimulation model. Calibrated weights. Calculated at individual level.





Source: MPiPS, GUS. *Notes:* Nominal PLN values.



Figure 5. Gross pension income distribution: 2005, 2008, 2011 and 2014



3.2 Changes in parameters of the wage distribution

A notable change over the analysed years with respect to the wage distribution was a substantial fall in the return to education, which accompanied the overall developments in education market in particular with a significant increase in the proportion of university graduates among of subsequent cohorts (see Table 4). With such changes in the education level of the workforce together with the so-called skill biased technological change which has been happening in parallel to these developments (Lewandowski et al., 2016), one could expect significant implications for inequality of earnings. However, as we shall see below there was little change in the inequality of earnings and the stability of the earnings distribution has contributed substantially to the overall developments in inequality. An important reason behind this were changes in the returns to education which reduced the overall effect of the shift in educational attainment.

The latter development is reflected in our wage regression analysis presented in Table 5, which shows key parameters of linear wage equations run on total labour costs for the four analysed years. For each year we show two specifications – one without and one with controls for occupation. For both sets of regressions we see a substantial fall in returns for all analysed levels of post-obligatory education. Returns to higher education fell from over 100% in 2005 to 80% in 2014 without controls for occupation, and from 57% to 40% with occupation controls. Corresponding numbers for secondary education were 57% in 2005 and 41% in 2014 without occupation controls and 31% and 24% in the second specification. The regressions also reflect the continued differences in the wage levels for men and women which are estimated at about 30%-35% in specifications without controlling for occupations and between 23%-28% with occupation controls.

| Table 4. Changes in education level among wage earners | | | | | | | | |
|--|--------|--------|--------|--------|--|--|--|--|
| | 2005 | 2008 | 2011 | 2014 | | | | |
| Education: | | | | | | | | |
| - higher | 20.95% | 21.43% | 27.01% | 29.6% | | | | |
| - secondary | 38.02% | 36.94% | 34.26% | 33.9% | | | | |
| - vocational | 32.06% | 31.71% | 30.59% | 29.54% | | | | |
| - primary or lower | 8.97% | 9.92% | 8.15% | 6.96% | | | | |
| | | | | | | | | |
| Observations | 28992 | 34859 | 34085 | 32863 | | | | |

Source: PHBS data, calibrated weights.

| Dependent variable: | | | | | | | | |
|---|--|--|--|--|--|--|--|--|
| Log total labour cost | 2005 | 2005 | 2008 | 2008 | 2011 | 2011 | 2014 | 2014 |
| Education: - higher - secondary - vocational | 1.044 ^{***} 0.567 ^{***} 0.289 ^{***} | 0.568 ^{***} 0.310 ^{***} 0.186 ^{***} | 0.877 ^{***} 0.492 ^{***} 0.264 ^{***} | 0.466 ^{***} 0.288 ^{***} 0.189 ^{***} | 0.851 ^{***} 0.455 ^{***} 0.240 ^{***} | 0.443 ^{***} 0.260 ^{***} 0.166 ^{***} | 0.795 ^{***} 0.413 ^{***} 0.224 ^{***} | 0.396 ^{***} 0.236 ^{***} 0.147 ^{***} |
| Female Occupation | -0.306 ^{***} No | -0.232**** Yes | -0.374*** No | -0.275*** Yes | -0.347 ^{***} No | -0.253*** Yes | -0.347 ^{***} No | -0.256*** Yes |
| Observations | 28992 | 28992 | 34859 | 34859 | 34085 | 34085 | 32863 | 32863 |

| Table 5. Parameters of the wage equation (linear estimates, log total labour costs as dependent variable) |
|---|
| with and without controls for occupation |

Source: own calculations using PHBS data.

Notes: significance level: p < 0.05, p < 0.01, p < 0.001; Other controls include: age polynomial, disability, voivodship, quarter. None/primary is taken as base category for education.

3.3 Changes in characteristics and distributional changes in wages

To identify the effect of changes in education levels (conditional on the changes in returns to education) and some other demographic characteristics on the entire distribution of earnings we apply the method of DiNardo, et al. (DiNardo et al., 1996).⁷ This approach addresses the question on how the distribution would have looked like in 2014 if population characteristics remained unchanged since 2005. The method relies on application of probability weight models to the distributions. To demonstrate the effect of demographic and education changes over the ten year period we generate two sets of weights based first on a model which controls only for demographic characteristics including age, gender and disability (Model 1), and second using a model which additionally controls for education (Model 2). The latter reflects the effect of demographic and education changes between 2005 and 2014, and thus addresses the question of how the distribution of earnings would have looked like, conditional on the changed returns to education, had education levels of the population and other characteristics remained unchanged. The results reflect three important insights. First of all, the general demographic changes between 2005-2014, including the change in the age distribution, have had only a minimal effect on wages. Secondly, and more importantly, despite the reduced returns to education, the general increase in education levels has substantially affected the distribution of wages. The mean counterfactual wage in 2014, assuming characteristics of the

⁷ The technical description of the DiNardo et al. (DiNardo et al., 1996) is presented in Appendix 1.

2005 population is 3265 PLN per month, compared to the actual mean in 2014 of 3556 PLN. Finally, the counterfactual inequality indicators presented in Table 6, suggest that the change in education levels has not resulted in higher degree of wage inequality, with the Gini under Model 2 being actually moderately lower at 33.2% compared to the actual inequality measure of 33.5%. One important conclusion from the latter finding, combined with results in Table 5, is that because there have been reductions in returns to education at all levels of education (relative to primary) and reductions in returns to higher education relative to all other levels, the changes in education levels have not resulted in increases in the overall wage inequality, which in turn limited the overall impact of labour market earnings on disposable income distribution. In our counterfactual exercise inequality of disposable income is slightly lower under Model 2 scenario, but this is due to the relative changes between incomes of households with and without labour market income.

| | Gini coefficients: | | | | | |
|---------------------------------------|--------------------|----------------------------|----------------------------|--|--|--|
| | Actual | Counterfactual: model 1 | Counterfactual: model 2 | | | |
| Total labour costs | | | | | | |
| (unequivalised) Total labour costs | 33.5 | 33.5 | 33.2 | | | |
| (equivalised) | 45.0 | 45.1 | 44.5 | | | |
| (equivalised) | 34.3 | 34.9 | 34.2 | | | |

 Table 6. Actual and counterfactual inequality of earnings and incomes: 2005-2014

Source: Own calculations using 2005 and 2014 PHBS, calibrated weights.

Notes: Counterfactual distributions using DiNardo et al. (1996) methodology.

Total labour costs - incomes from both permanent and temporary employment.

Using estimates from Model 1 we see a slight increase in the density of total labour cost from wages for incomes lower than about 2700 PLN, which results from the fact that the 2005 population is slightly younger then the population observed in 2014. Adding education in Model 2 creates a significant shift in the density for labour costs above about 3000 PLN. Overall gross income drops on average from 3555 PLN to 3490 PLN in Model 1 and to 3265 PLN in Model 2. This is equivalent to reductions of 1.2% and 8.2% respectively. Thus as we can see, even in this simple example of reweighting the contribution of different demographic groups, the observed changes in characteristics, and in particular in education, substantially contributed to increases in the level of wages between 2005 and 2014.



Figure 6. Total labour costs distribution in 2014 with applying characteristics from 2005 using two models

Notes: Details of the characteristics controlled for in Models 1 and 2 presented in the Appendix.

4 Tax and benefit reforms and disposable incomes

As we saw above there have been several important developments in the labour market that contributed to containing growth in income inequality in Poland over the period 2005-2014. These included increasing employment level, in particular among older workers, substantial changes in the level of education and a parallel development which implied significantly lower returns to education with narrowed down differences in wage levels between the better and the worse educated. The latter could have simply reflected a general equilibrium effect of changes in education structure, but can also be a sign of shifting returns as a result of emigration of large numbers of working age individuals of whom a significant proportion were people with less than higher education.

The second set of changes which may have played an important role in affecting developments in incomes are fiscal measures in terms of direct taxation and benefit policy. In this section we first document the changes in the tax and benefit system implemented between

2005 and 2014 (Section 4.1), analyse the degree of progressivity of the different elements of the system and show how this progressivity changed as a result of the implemented reforms (Section 4.2). Finally in Section 4.3 we apply the method of Bargain and Callan (Bargain and Callan, 2010) to decompose changes in incomes with the aim to identify the role of tax and benefit policy in determining inequality and poverty levels.

4.1 Tax and benefits system changes

Several important events determined the path of fiscal policy between 2005 - 2014. 2005 was the first full year of Poland's membership of the EU while the global financial crisis broke out in 2008. The country had a snapshot election in 2007, followed by two terms of Parliament with subsequent elections in 2011 and 2015. Both the external developments and the political calendar played an important role in determining the scope of tax and benefit policies implemented over this period. The system of direct taxes and benefits in Poland and the reforms which took place since 2005 are briefly described below.⁸

Social Security Contributions

Social Security Contributions (SSC) from employment constitute the basis of the Social Security benefits system including among others retirement and disability pensions and unemployment benefits. Farmers are subject to a separate insurance system (KRUS) in which they pay contributions based on the area of their farming land with additional contributions for those who own non-farming business. For wage employees the SSCs are nominally divided between the employer and the employee. Gross income, defined as the total labour costs less employer's SSC serves as the basis for calculating these contributions. Retirement and disability pension contributions are being paid up to an annual threshold set at the level of 30 times the projected average monthly gross wage in the next year. For the self-employed the contributions are calculated based on 60% of the projected average gross wage for the next year and are thus independent from actual income. Table 7 presents the SSC rates and changes between the years.

Major changes to SSC rates occurred in 2007, when the ruling coalition government changed the rates of disability insurance. In July 2007 the employee rate was lowered from 6.5% to 3.5% and in January 2008 the rate went further down to 1.5% with the employer rate cut from 6.5% to 4.5%. The newly elected PO-PSL government upheld the SSC rate reductions until

⁸ This section draws on (Myck et al., 2015).

2012 when employer's disability insurance rate went back up to 6.5%.

| Table 7. Social Security Contributions for employment income in years 2005-2014 | | | | | | | |
|---|-------|-------|--------|--------|--|--|--|
| | 2005 | 2008 | 2011 | 2014 | | | |
| Employee SSC: | | | | | | | |
| retirement insurance | 9.76% | 9.76% | 9.76% | 9.76% | | | |
| disability insurance | 6.50% | 1.50% | 1.50% | 1.50% | | | |
| illness insurance | 2.45% | 2.45% | 2.45% | 2.45% | | | |
| Employer SSC: | | | | | | | |
| retirement insurance | 9.76% | 9.76% | 9.76% | 9.76% | | | |
| disability insurance | 6.50% | 4.50% | 4.50% | 6.50% | | | |
| work accident insurance | 1.93% | 1.80% | 1.67% | 1.93% | | | |
| Labour Fund | 2.45% | 2.45% | 2.45% | 2.45% | | | |
| FGEB | 0.15% | 0.10% | 0.10% | 0.10% | | | |
| Annual SSC threshold [PLN] | 72690 | 85290 | 100770 | 112380 | | | |
| Self-employed: | | | | | | | |
| Annual base [PLN] | 16983 | 20929 | 24185 | 26971 | | | |
| Farmers: | | | | | | | |
| pension and disability insurance [PLN] | 675.2 | 752 | 870 | 1005 | | | |
| accident, illness and maternity insurance [PLN] | 264 | 312 | 486 | 504 | | | |
| for non-farming business [PLN] | 0 | 0 | 1740 | 2010 | | | |
| additional contribution [PLN] | 0 | 0 | 1035 | 1209 | | | |

Before 2010 a single and uniform SSCs existed for every farmer, independent from their income or land. In 2010 the PO-PSL coalition introduced an additional contribution to be paid for farms bigger than 50 hectares. For each additional 50ha up to 300ha farmers pay additional contributions. Farmers who are also involved in non-farming business were taxed at different rates (see Table 7). These changes had a minor impact on most farmers in Poland due to the fact, that most farms are below 50 ha.

Personal Income Tax and Health Insurance

Gross income, after deducting the SSCs paid by the employee (taxable income), is subject to the Personal Income Tax (PIT). For permanent employment a constant revenue cost is deducted first. For contract work the revenue cost is calculated as a percentage of taxable income (20%). Poland for a long time had a three rate progressive system of income taxation with rates at 19%, 30% and 40%. This system was reformed in 2006 with a two rate system coming into force beginning with January 2009 with rates set at 18% and 32%. Parameters for the PIT system are presented in Table 8. Each taxpayer can also deduct a universal tax credit

(UTC), the value of which is calculated with reference to the tax free allowance.

The amounts of revenue cost and UTC have remained at the same nominal level since 2008. Additionally the highest income threshold for the PIT has been unchanged since 2007. The fiscal drag related to freezing of these parameters has resulted in effective increases in the level of taxation with highest proportional effects focused on low income families (Myck et al., 2013; Myck et al., 2011).

The tax calculated using the tax rates is reduced by the deductible part of Health Insurance (HI) contributions (7.75%). Health Insurance is paid proportionally to taxable income at the rate of 9% (since 2007). It is possible to deduct 7.75% of taxable income which is paid in the form of HI contributions from the calculated tax due. For the self-employed the full and deductible amount of HI is calculated proportionally to 75% of average gross monthly wage in the 4th quarter of the previous year.

| | 2005 | 2008 | 2011 | 2014 |
|-------------------------------------|-------|-------|-------|--------|
| Revenue cost [PLN] | 1227 | 1335 | 1335 | 1335 |
| Universal Tax Credit [PLN] | 2790 | 3091 | 3091 | 3091 |
| Income threshold I [PLN] | 37024 | 44490 | 85528 | 85528 |
| Income threshold II [PLN] | 74048 | 85528 | - | - |
| Tax rate I | 19% | 19% | 18% | 18% |
| Tax rate II | 30% | 30% | 32% | 32% |
| Tax rate III | 40% | 40% | - | - |
| Child Tax Credit [PLN/month] | - | 97.81 | 92.67 | 92.67 |
| Child Tax Credit threshold | - | - | - | 112000 |
| Price of rye [PLN/qa] | 38 | 58.29 | 37.64 | 75.86 |
| Full Health Insurance | 8.50% | 9.00% | 9.00% | 9.00% |
| Deductible Health Insurance | 7.75% | 7.75% | 7.75% | 7.75% |
| Base for HI for self-employed [PLN] | 22264 | 27671 | 32452 | 34898 |

Table 8. Personal Income Tax and Health Insurance system parameters for years 2005-2014

The year 2007 also introduced the child tax credit (CTC) for every child younger than 18 and younger than 25 when still in education. Until 2014 the CTC operated as a non-refundable tax credit and could only be claimed if enough tax has been paid. This implied that many low income families could not take the full advantage of the CTC which meant that the policy was most generous for middle and high income families. The policy was reformed a number of times (see Table 8) with the most important of these coming into effect in 2014. Since then families who could not claim the full credit due to low taxes paid, can claim it up to the

amount of Social Security Contributions and Health Insurance.

Farmers in Poland do not pay PIT. They are obliged to pay Agricultural Tax depending on their farming area and on price of 1 quintal of rye, as published by the Central Statistical Office (GUS). Until 2012 farmers also did not need to pay any Health Insurance. Since 2012 health insurance for farmers with farms greater than or equal to 6 ha is 1 PLN per ha of land as Health Insurance. Those with farms smaller than 6 ha get their insurance paid by the government.

Family Benefits and Social Assistance

Family Benefits (FB) in Poland consist of a number of benefits with the main Family Allowance (FA) supplemented with a number of additional payments related to specific family circumstances. These benefits are means-tested and until 2015 were subject to a point withdrawal scheme under which income even slightly above a specified threshold meant that the families could not claim any of the principal benefits. Both the threshold and the values of benefits are usually subject to indexation every three years, but for a number of years they have been kept frozen at nominal values. This on the one hand, led to decreasing number of eligible families and on the other to lower real values of benefits for those who still qualified. For example the eligibility threshold for the FA eligibility stayed at the same level from 2005 until November 2012. In the same years the number of children for which the Family Allowance (FA) was paid dropped from 5.2m children in 2005 to 2.2m children in 2014. The values of the Family Benefits system in the analysed years are presented in Table 9. Although periodically frozen, the amounts of FA and its supplements have been gradually increasing and the system of calculating benefits changed in 2006. Since that year the amounts have been conditional on the age of children in families rather than on the sequence of children in the family. In 2006 the government introduced a universal child birth allowance ("becikowe") at the value of 1000 PLN for every new-born child. The benefit which was initially universal became means-tested in 2013.

A number of benefits exist to support families who take care of disabled family members. The Nursing Supplement (NS) is an additional payment made by the Social Security Institution (ZUS) to people receiving disability pensions and unable to live an autonomous existence or work and is automatically paid to all persons above 75 years. This benefit increased from 144.25 PLN per month in 2005 to 206.76 PLN in March 2014. The Nursing Benefit (NB) is

granted to disabled children aged 16 and less, severely disabled persons above that age, mildly disabled persons if their disability occurred before the age of 21 and persons aged 75 or more. Individuals aged 75+ cannot simultaneously receive the NB and NS benefits. Regulations concerning NB are part of the family benefits bill and as such NB is uprated more arbitrary. It increased from 144 PLN in 2005 to 147 PLN the next year and to 153 PLN in 2007. It has not been increased since then. The Nursing Allowance (NA) on the other hand is a special benefit for parents who resign from work to take care of disabled children. The amount of NA had remained at the same level from 2005 to November 2009 when it was increased from 420 PLN per month to 520 PLN. The NA was means tested until 2010 when it became a universal benefit with no income test.

| | 2005 | 2008 | 2011 | 2014 |
|--|--------|--------|--------|--------|
| FA income threshold [PLN per capita] | 504 | 504 | 504 | 544.8 |
| - Families with disabled children | 583 | 583 | 583 | 629.8 |
| Income from 1 ha for FA criterion | 174.5 | 167.1 | 169.2 | 214.7 |
| FA amount 1 | 43 | 48 | 68 | 77 |
| FA amount 2 | 53 | 64 | 91 | 106 |
| FA amount 3 | 66 | 68 | 98 | 115 |
| FA Supplements: | | | | |
| Parental Leave Allowance | 400 | 400 | 400 | 400 |
| Support for Large Families | 20 | 80 | 80 | 80 |
| Support for Child Birth | 500 | 1000 | 1000 | 1000 |
| School Start Supplement | 90 | 100 | 100 | 100 |
| Support for Lone Parents (SLP): | | | | |
| - Support for Lone Parents | 170 | 170 | 170 | 170 |
| - Additional SLP for disabled | | | | |
| children | 80 | 80 | 80 | 80 |
| - SLP max | 340 | 340 | 340 | 340 |
| - SLP max for disabled children | 160 | 160 | 160 | 160 |
| Supplement for education and rehabilitation of disabled child (SEDC) | | | | |
| - up to 5 y.o. | 50 | 60 | 60 | 60 |
| - between 5 and 24 y.o. | 70 | 80 | 80 | 80 |
| Child Birth Allowance ("becikowe") | - | 1000 | 1000 | 1000 |
| Nursing Supplement | 144.25 | 161.50 | 185.70 | 206.10 |
| Nursing Benefit | 144 | 153 | 153 | 153 |
| Nursing Allowance | 420 | 420 | 520 | 940 |

Table 9. Family Allowance system parameters for years 2005-2014 in PLN

Note: FA amount 1 – amount for the 1st and 2nd child in 2005 and for each child less than 5 years in other years; FA amount 2 – amount for the 3rd child in 2005 and for each child between 5 and 17 in other years; FA amount 3 – amount for the 4th child in 2005 and for each child between 18 and 23 in other years. All values re in PLN per month, except for CBA and SCB, which are paid once per child birth and SS which is paid once a year.

A number of substantial changes have been made in the social security system for parents of new-born children. These changes included extending the period of paid maternity leave in 2007 from 16 to 18 weeks and in 2009 by another 2 weeks to 20 weeks. In 2010 the PO-PSL coalition introduced an additional 2 week maternity leave supplementary to the maternity leave already effective. Duration of this additional leave has been extended in 2012 to 4 weeks and in 2013 to 6 weeks. A special one week paternal leave for fathers of new-born children was introduced in 2010 and was extended in 2012 to two weeks. In 2013 the total length of leave due to child birth was extended to 52 weeks with the introduction of an additional 26 week parental leave. Changes in maternity leave duration for the analysed years are summarised in Table 10. Overall the period of total possible maternity leave increased from 16 weeks in 2005 to 52 weeks in 2014.

| Table 10. Duration of maternity leave in weeks for the years 2005-2014 together with additional leave |
|---|
| periods. |

| | 2005 | 2008 | 2011 | 2014 |
|----------------------------|------|------|------|------|
| Maternity leave | 16 | 18 | 20 | 20 |
| Additional maternity leave | | | 2 | 6 |
| Parental leave | | | | 26 |
| Paternity leave | | | 1 | 2 |

Note: Based on (Myck et al., 2015).

Housing Benefit and Social Assistance

Depending on the number of household members and area of household for persons with net income less than 175% of minimum pension (125% per capita for non-single households) a household might be eligible for Housing Benefit (HB). The amount of this benefit is calculated as the difference between housing expenditures and a specified percentage (depending on household size) of household income. For the years 2005 – 2014 the eligibility criteria and housing benefit rules have not changed significantly. Since 2014 the so-called vulnerable consumers of energy (identified as those eligible to HB) are entitled to an additional Energy Supplement amounting to 11.36 PLN monthly for single person households, 15.77 PLN for households with 2 to 4 persons and 18.93 PLN for households with more than 4 members.

Table 11. Housing Benefit and Social Assistance system parameters for years 2005-2014 [PLN per month]

| | 2005 | 2008 | 2011 | 2014 |
|----------------------|-------|--------|--------|--------|
| Housing Benefit: | | | | |
| Minimum pension | 562.6 | 629.8 | 724.5 | 842.2 |
| 175% Minimum pension | 962.0 | 1077.0 | 1238.9 | 1440.2 |

| 125% Minimum pension | 703.2 | 787.3 | 905.6 | 1052.8 |
|--|-------|-------|-------|--------|
| Social Assistance (SA): | | | | |
| SA income threshold (single person) | 461 | 477 | 477 | 542 |
| SA income threshold (per capita in family) | 316 | 351 | 351 | 456 |
| SA income from 1 ha | 194 | 207 | 207 | 250 |
| Permanent SA (PSA) maximum | 418 | 444 | 444 | 529 |

Social Assistance in Poland targets help to the most disadvantaged low-income households. It comprises principally of Permanent Social Assistance (PSA) and Temporary Social Assistance (TSA). PSA is granted to adults who are permanently unable to work due to age or other reason with income per capita less than SA income threshold (different for single person households and families, see Table 11). PSA is calculated as a difference between SA income threshold and income per capita, and the amounts paid cannot be not less than 30 PLN or more than the specified maximum value of PSA. This maximum value of has increased from 418 PLN in 2005 to 444 PLN in October 2006 and has been set at 529 PLN since October 2012. During this period the income threshold for SA has been increased from 316 PLN per capita in 2005 (461 PLN for single person households) to 351 PLN (477 PLN) in October 2006 and finally to 456 PLN (542 PLN) in October 2012.

Temporary Social Assistance is granted in situations including long-term sickness, disability, unemployment, or keeping or granting of other benefits. It is subject to the same income criterion as the PSA, but it is calculated as at least 50% of the difference between income and the income threshold, but not less than 20 PLN. Only 50% of the difference is guaranteed by the central budget, while the other 50% (or less) may be financed by local authorities. Eligibility for Social Assistance does not depend solely on income and is subject to a subjective asset test conducted by social workers who determine if families are or are not eligible to receive support.

4.2 Progressivity and redistributive effect of the Polish tax and benefit system

The reforms of the different elements of the system described above have had direct effects on the degree of its redistributive implications. To quantify these changes we follow the methodology described in (Callan and Walsh, 2006; Verbist and Figari, 2014) and calculate the total Redistributive Effect (RE) of the tax and benefit system as the effect of inequality

reduction without re-ranking minus the effect of re-ranking. The first indicator of Vertical Equity (VE) can be calculated using the Reynolds-Smolensky index (Reynolds and Smolensky, 1977), as the difference between the Gini coefficient of gross income, before taxes and transfers (G_{gross}), and the concentration coefficient of net disposable income, that is income after taxes and transfers (C_{net}).

$$RS = G_{gross} - C_{net}$$

The RS index can be interpreted as twice the area between the Lorenz curve of gross incomes and the concentration curve of net incomes, ranked according to gross incomes, or in other words as the reduction in inequality without ranking change.

Some individuals receiving transfers might end up with higher net income than those with greater gross, pre-tax income who were paying taxes. To account for the possible re-ranking we use an index (RR) described in (Atkinson, 1979) and (Plotnick, 1981) as the difference between the Gini coefficient of net income (G_{net}) and the concentration coefficient of net income (C_{net}), ranked according to gross incomes.

$$RR = G_{net} - C_{net}$$

Using these two indices we can compute the Redistributive Effect (RE) as:

$$RE = RS - RR = (G_{gross} - C_{net}) - (G_{net} - C_{net}) = G_{gross} - G_{net}$$

Table 10 presents calculated Gini coefficients for gross and net incomes together with net income concentration coefficient for the analysed years. It also includes calculated RS, RR and RE indexes.

Table 12. Redistributive effect of the tax and benefit system in the analysed years 2005 2008 2011 2014 Gini – gross income (TLC) 42.81 40.59 40.24 39.90 Gini – net disposable income 35.05 34.45 34.64 34.28 Concentration coefficient – net disp. income 32.18 32.75 33.00 32.50 Redistributive Effect (RE = VE - RR) 5.60 5.62 7.75 6.14 Reynolds-Smolensky (VE) 10.62 7.84 7.24 7.40 Re-ranking (RR) 1.64 2.87 1.70 1.78

Notes: Gross and disposable incomes expressed as per capita 2005 PPP USD. Negative disposable incomes have been replaced with 0 (159 obs. in 2005, 203 obs. in 2008, 208 obs. in 2011 and 190 obs. in 2014). Gross incomes include employer's SSC.

As we see in Table 12 the Gini coefficient for gross (equivalised) incomes fell between 2005

and 2014 by 2.9pp which reflects our earlier analysis and values presented in Tables 3 and 6. This drop was accompanied by a very small drop in net income Gini by 0.8pp. The difference between the two Gini coefficients, the Redistributive Effect of the tax and benefit system thus dropped from 7.8pp in 2005 to 5.6pp in 2014 with the largest drop between 2005 and 2008, when the index fell to 6.1pp. The fact that the RE recorded such a significant drop between 2005 and 2008 is interesting as in this period Poland was governed by a coalition which was declaratively strongly in favour of more and not less redistribution.

The observed change in the RE reflects reductions in Social Security Contributions, which affected incomes of the working population, introduction of the Child Tax Credit, which largely benefited middle and high income families with children and the policy of freezing of parameters of the tax system which proportionally had the most significant effect on low income households. Stability of the RE in the following years combines the redistributive effects of increases in benefits with the regressive effect of the 2009 PIT reform. The continued policy of freezing of tax parameters in later years was complemented with higher values of Family Benefits and the implementation of the refundable CTC in 2014, which benefited low income families.

Kakwani measure of progressivity

To measure the progressivity of the different elements of the Polish tax and benefit system we use the Kakwani index (Kakwani, 1977). This index is equal to the difference between the Gini coefficient of the gross income and concentration coefficient of a specific tax or benefit instrument:

$$K_{tax} = G_{gross} - C_{tax}$$

At $K_{tax} = 0$ the tax is proportional, $K_{tax} > 0$ suggests progressive and $K_{tax} < 0$ regressive nature of the analysed instrument. In our analysis we concentrate on different categories of income. We do so in order to distinguish between different taxes paid for different incomes. For example there are no Social Security Contributions being paid from pension income. Moreover, farmers enjoy a completely different system, where they are taxed according to land area and not income. We thus define labour income as income from permanent, temporary and self-employment. The pensions category on the other hand includes income from retirement and family pensions.

Figure 7 presents Lorenz curves for total gross income (total labour costs) and concentration

curves for different income categories. Detailed indexes calculated for several definitions of gross income are given in Table 13.





Notes: Per capita income in 2005 PPP USD terms.

Table 13 computes the Kakwani indexes for four groups of income and in each case we calculate the Kakwani indexes for PIT tax (together with HI contributions) and total tax (PIT + HI + SSC_{EE} + SSC_{ER}). We also included mean, median and inequality characteristics for the analysed income categories. We define gross incomes in terms of total labour costs. In case of multiple income sources we treat income tax and HI as paid proportionally to share of a specific income category in total taxable income.

The most notable change in the progressivity of personal income tax can be identified between 2008 and 2011 which falls for the period of implementation of the two-rates tax system (in January 2009). When we look at labour income the Kakwani index for the PIT falls from 12.6 to 10.0. The results of the reform can also be seen for pensions (Kakwani falls by 1.2) and for total gross income (fall by 2.5). Interestingly the reforms introduced between 2011 and 2014 increased the degree of progressivity of the system, and the most likely reason behind it is the introduction of the CTC reform in 2014 which made the credit refundable for low income families.

The Kakwani index for total taxation remains close to neutral due to the proportional payment

of SSCs for permanent and temporary employment and flat amounts of these contributions paid by self-employed. Since the self-employed actually pay a flat amount of the SSCs, the whole system of SSCs is actually regressive. Together with the slightly progressive PIT structure the entire Polish direct tax system is more or less proportional.

Pensions on the other hand are not subjected to SSC payment and the degree of progressivity of the full direct taxation system with respect to pension incomes is essentially the same as that of the PIT/HI. Average pensions are much lower than labour incomes and they are more equally distributed, as a result pension income often falls into the first tax bracket which makes the PIT system for pensions close to a flat system resulting in lower values of the Kakwani index compared to labour incomes.

Farming income, as presented in Figure 7, is concentrated more unequally than labour income. Adding this income to labour income increases inequality, as expressed by the increase of the Gini coefficient and P90/P10 ratio (Table 13, Panel C) in comparison to market income without farming (Panel A). In general farmers are excluded from the PIT system and SSC for employees. Farmers instead pay an agricultural tax that is proportional to farming land area and special SSC (KRUS) that until 2010 were independent even from the land area. This results in a strongly regressive PIT and total tax system for farmers, which is reflected in lower progressivity compared to labour income alone (Panel A).



Figure 8. Lorenz and concentration curves for taxes and benefits by total gross income

Notes: Per capita in 2005 PPP USD terms.

Combining labour, agriculture and pension incomes together in Panel D generates Kakwani indexes that might at first look unintuitive. Here we see the reverse, where after 2008 total tax seems to be more progressive than PIT tax. The explanation to this is that given that there are no SSCs paid from pension incomes and that many pensioners are in the lower half of the income distribution, the total tax paid becomes progressive, as many low-income individuals are not subject to SSCs. Thus when analysing the entire tax and benefit system it is important to have in mind that different incomes are subject to different forms of taxation and they need to be analysed separately to give a clearer picture of tax progressivity. The limited degree of progressivity of the Polish tax system has also been reported for the previous years (Jos Verbeek et al., 2004).

| | | 2005 | 2008 | 2011 | 2014 |
|------------------------------|-------------------|--------|--------|--------|--------|
| A) Labour | Mean | 472.48 | 577.35 | 621.32 | 664.79 |
| income | Median | 342.47 | 436.74 | 477.20 | 508.83 |
| | P90/P10 | 8.94 | 8.45 | 7.99 | 7.19 |
| | Gini | 44.6 | 43.0 | 42.1 | 41.1 |
| | Kakwani PIT+HI | 11.8 | 12.5 | 9.8 | 12.0 |
| | Kakwani total Tax | 0.5 | 1.2 | 0.7 | 1.2 |
| B) Pensions | Mean | 284.27 | 301.12 | 326.37 | 357.08 |
| | Median | 213.46 | 220.49 | 243.40 | 266.51 |
| | P90/P10 | 9.23 | 9.57 | 9.60 | 10.05 |
| | Gini | 42.2 | 43.1 | 42.8 | 43.1 |
| | Kakwani PIT+HI | 3.9 | 4.6 | 3.7 | 3.1 |
| | Kakwani total Tax | 3.9 | 4.6 | 3.7 | 3.1 |
| C) Labour | Mean | 460.36 | 583.57 | 624.41 | 670.55 |
| and agricul- tural income | Median | 334.20 | 436.87 | 476.55 | 515.51 |
| | P90/P10 | 11.37 | 10.65 | 10.70 | 8.79 |
| | Gini | 46.7 | 45.3 | 44.6 | 43.5 |
| | Kakwani PIT+HI | 11.0 | 10.4 | 7.9 | 9.3 |
| | Kakwani total Tax | 1.0 | 0.3 | -0.5 | -0.2 |
| D) Labour, | Mean | 480.80 | 592.54 | 623.77 | 668.53 |
| agricultural, | Median | 378.97 | 477.25 | 510.58 | 550.87 |
| other income | P90/P10 | 9.28 | 7.42 | 7.62 | 7.56 |
| | Gini | 42.8 | 40.6 | 40.2 | 39.9 |
| | Kakwani PIT+HI | 3.1 | 4.9 | 3.6 | 3.9 |
| | Kakwani total Tax | 1.7 | 2.5 | 2.5 | 2.2 |
| | Kakwani benefits | -81.09 | -80.45 | -77.55 | -77.98 |

Table 13. Kakwani indexes together with summaries and inequality indicators for income categories

Notes: Individual incomes and taxes are divided proportionally to specific income share in gross income in case

of multiple income sources. Incomes and taxes are equivalised on the household per capita level using the 2005 PPP USD. Pensions include only retirement and family pensions.

4.3 Decomposition of effects of policy reforms on income distribution

The analysis presented above describes how the tax and benefit system influences the distribution of disposable income at a given point in time and how the degree of progressivity of the different elements of the system changed between different years. These changes, however reflect a number of developments. For example the degree of progressivity of taxes might change due to the changes in the underlying distribution of incomes, i.e. even without any changes to the tax system itself. To analyse how changes in tax and benefit policy influenced the income distribution we implement a method proposed by Bargain and Callan (Bargain and Callan, 2010). The authors apply microsimulation modelling to decompose poverty and inequality changes into those which are due to policy reforms and other effects. They make use of the Shorrocks method of decomposition based on the Shapley value (Shorrocks, 2012). A similar approach can be found in (Morawski and Semeniuk, 2013).

Difference in inequality or poverty measures G can be understood as differences between these measures on disposable income in period 1 (d_1) and disposable incomes in period 0 (d_0), where disposable incomes are a function of tax and benefits policy parameters p and underlying incomes y. Following Bargain and Callan (2010) we can write that the observed differences in inequality between two periods (Δ) are equal to:

$$\Delta = G[d_1(p^1, y^1)] - G[d_0(p^0, y^0)]$$

Assuming that the data and tax-benefit policy parameters are subject to nominal changes by a parameter α^1 this can be represented by two decompositions. First one where the policy effect is conditional on final data and second one where this effect is conditional on the initial data.

The first decomposition, where the policy effect is conditional on the final data can be written as follows:

$$\Delta = \{G[d_1(p^1, y^1)] - G[d_0(\alpha^1 p^0, y^1)]\} \text{ (policy effects)} \\ + \{G[d_0(\alpha^1 p^0, y^1)] - G[d_0(\alpha^1 p^0, \alpha^1 y^0)]\} \text{ (other effects)} \\ + \{G[d_0(\alpha^1 p^0, \alpha^1 y^0)] - G[d_0(p^0, y^0)]\} \text{ (nominal change effects)}$$

The second decomposition has the following form:

$$\Delta = \{G[d_1(p^1, y^1)] - G[d_1(p^1, \alpha^1 y^0)]\} \text{ (other effects)} \\ + \{G[d_1(p^1, \alpha^1 y^0)] - G[d_0(\alpha^1 p^0, \alpha^1 y^0)]\} \text{ (policy effects)}$$

+{
$$G[d_0(\alpha^1 p^0, \alpha^1 y^0)] - G[d_0(p^0, y^0)]$$
} (nominal change effects)

In other words policy effects can be described in case of the second decomposition as the differences between inequality or poverty measures for policy from period 1 with parameters from this period on data from period 0 uprated by α^1 less inequality or poverty for policy from period 0 with parameters from period 0 uprated to period 1 on data from period 0 uprated to period 1.

Bargain and Callan (2010) also assume linear homogeneity of the tax and benefit systems, meaning:

$$d_i(\alpha p^j, \alpha y^l) = \alpha d_i(p^j, y^l)$$

or in other words, that the disposable income of system parameters and data uprated by α is equal to disposable income uprated by this same value. Assuming that measure G is independent of nominal changes we get:

$$G[d_0(\alpha^1 p^0, \alpha^1 y^0)] = G[d_0(p^0, y^0)]$$

thus reducing the nominal change effects to zero, leaving only policy and other effects in the decomposition. Based on this method authors devise a, Shorrocks-Shapley decomposition, averaging effects of the two decompositions, as shown below:

$$policy \ effect: \ \frac{1}{2} \{ G[d_1(p^1, y^1)] - G[d_0(\alpha^1 p^0, y^1)] \} \\ + \frac{1}{2} \{ G[d_1(p^1, \alpha^1 y^0)] - G[d_0(p^0, y^0)] \} \\ other \ effects: \ \frac{1}{2} \{ G[d_0(\alpha^1 p^0, y^1)] - G[d_0(p^0, y^0)] \} \\ + \frac{1}{2} \{ G[d_1(p^1, y^1)] - G[d_1(p^1, \alpha^1 y^0)] \}$$

For our analysis we use the PHBS data and apply annual nominal wage increase to uprate both data and the system parameters. Table 12 presents the resulting Shorrocks-Shapley decomposition and Decomposition II following Bargain and Callan (2010) for the Gini and decile inequality measures together with poverty rate for the period of 2005 - 2014. Columns (0) and (1) have the same values of inequality measures, thus giving merit to the assumption of tax and benefit system homogeneity and independence of our measures from nominal changes.

Looking at results for both Shorrocks-Shapley and Bargain and Callan decomposition we find

that the total policy package in the period 2005-2014 had a minor effect on inequality, and depending on the decomposition amounts to -0.3pp in the first measure and -0.5pp in the second. The total "other" effect on inequality is also very small and for the two measures is a mirror image of the policy effect. The two measures show an interesting pattern of consequences of policy and other effects over time. While in the period 2005-2008 the slight increase in the Gini coefficient was nearly entirely driven by other factors, the stability of inequality between 2008-2011 was largely due to factors outside of the policy sphere, with the latter contributing to increases in inequality. This reflects the strongly reduced progressivity of the tax and benefit system which we discussed in Section 4.2 related largely to the introduction of the two-rate personal income tax. In the final years of the analysed period both the policy factors and other developments contributed to reductions in inequality of about 0.7pp in the Gini index. A different pattern emerges when we look at the implications of policy substantially contributed to reducing poverty in the analysed period and cushioned the implications of other factors which overall contributed to increases in the poverty rate.

5 Conclusions

Between 2005 and 2014 incomes of Polish households increased substantially. The mean value of earnings (measured as total labour costs) calculated on the basis of data in the Polish Household Budget Surveys went up from 2139.20 PLN in 2005 to 3555.90 PLN in 2014 (an increase of 66%), while the mean value of pensions grew from 1055.20 PLN to 1677.30 over the same period (up by 59%). At the same time the overall level of inequality has been relatively stable, with the Gini coefficient falling from 0.351 to 0.343 over the period of these ten years. Perhaps the most surprising result we find, and a factor which contributed to containing or reducing the overall level of inequality, is that despite a relatively rapid economic growth between 2005 and 2014, the inequality of earnings, as measured by the Gini coefficient, has declined (from 0.419 to 0.384). Several factors may have contributed to these developments including rapid expansion of educational achievements of a large part of the population and significant outward migration which took place after Poland joined the European Union in 2004.

However, an important factor which contributed to the reduced income inequalities was the

tax and benefit policy package introduced after 2005, and especially the policies implemented in the initial part of the analysed period (2006-08) and the final three years (2012-2014). These policies outweighed the effect of measures introduced in between these periods, in years 2009-2011, which included in particular the reform of the income tax system. This reform reduced the progressivity of PIT and brought most significant benefits to high income households. The most important measures which contributed to reduction of poverty and inequality were the introduction of the Child Tax Credit in 2007 and its extension to low income families in 2014, as well as a series of reforms to Family Benefits which increased the level of support to low income families with children.

Recent policies implemented and announced by the new government since October 2015, and in particular the generous family support programme "Family 500+" will work to further reduce income inequality in Poland. As we showed in our analysis the level of progressivity of the tax system in Poland has been historically comparatively low. Since it seems unlikely that the trends in the inequality of earnings which were observed between 2004-2015 will continue in the future due to lower migration and reduced pace of educational expansion, the tax and benefit system might play an increasing role in containing or reducing income inequality. This means that shifting the tax burden more towards high income households may be necessary in order to ensure inclusive growth in Poland in the coming years.

| Data year | 0 | 0 | 1 | 0 | 1 | Total | Homogeneity | Shorrocks-Shaple | y decomposition | Decomposition II | |
|------------------|-------|-------|-------|-------|-------|---------|-------------|------------------|------------------|------------------|---------------|
| Uprated to | | 1 | | 1 | | change | change | | | | |
| Policy year | 0 | 0 | 0 | 1 | 1 | | - | Tax-benefit | Other effects | Tax-benefit | Other effects |
| Uprated to | | 1 | 1 | | | | | Mean of | Mean of | poncy effect | |
| | (0) | (1) | (2) | (3) | (4) | (4)-(1) | (1)-(0) | (4)-(2), (3)-(1) | (2)-(1), (4)-(3) | (3)-(1) | (4)-(3) |
| Gini | 35.05 | 35.00 | 34.52 | 34.60 | 34.28 | -0.72 | -0.06 | -0.32 | -0.40 | -0.40 | -0.32 |
| Poverty rate (%) | 20.69 | 20.69 | 20.89 | 20.14 | 20.57 | -0.12 | 0.00 | -0.44 | 0.31 | -0.55 | 0.43 |
| P90/P10 | 4.83 | 4.81 | 4.71 | 4.56 | 4.57 | -0.25 | -0.02 | -0.20 | -0.05 | -0.25 | 0.01 |
| P90/P50 | 2.15 | 2.15 | 2.02 | 2.14 | 2.03 | -0.12 | 0.00 | 0.00 | -0.11 | -0.01 | -0.11 |

Table 12 Decomposition of changes in income distribution for Poland for years 2005 and 2014

Notes: Per capita 2005 PPP USD disposable income. Households with negative disposable income have its value replaced with 0. Poverty line 60% of median disposable income per capita.



Figure 9. Decomposition of changes in inequality and poverty rates (a) Shorrocks-Shapley (b) Decomposition II

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6 Appendix:

6.1 Poverty ratios and inequality for simulated incomes

 Table A1. Poverty ratios and inequality measured by the Gini coefficient for different weights and years for incomes simulated using SIMPL.

| | 2005 | 2008 | 2011 | 2014 |
|----------------------------------|--------|--------|--------|--------|
| Original grossing up weights | | | | |
| Median disposable income | 295.97 | 390.53 | 416.98 | 438.91 |
| Poverty line | 177.58 | 234.32 | 250.19 | 263.34 |
| Gini | 35.1 | 33.5 | 33.7 | 32.8 |
| Relative pov. | 20.1% | 18.1% | 19.1% | 19.5% |
| – less than 18 y.o. | 33.0% | 29.3% | 30.3% | 29.8% |
| - 65+ | 5.0% | 6.7% | 6.7% | 6.7% |
| Abs. pov.: 5\$ per day | 13.6% | 5.4% | 5.1% | 3.7% |
| Abs. pov.: 10\$ per day | 50.9% | 31.7% | 27.9% | 25.7% |
| Weights corrected for population | | | | |
| structure and income sources | | | | |
| Median disposable income | 303.18 | 385.75 | 409.59 | 437.45 |
| Poverty line | 181.91 | 231.45 | 245.76 | 262.47 |
| Gini | 34.7 | 34.1 | 34.2 | 33.5 |
| Relative pov. | 19.5% | 18.2% | 19.6% | 19.8% |
| – less than 18 y.o. | 32.1% | 28.8% | 30.0% | 28.9% |
| - 65+ | 5.0% | 6.9% | 7.1% | 8.0% |
| Abs. pov.: 5\$ per day | 12.3% | 5.7% | 5.7% | 4.2% |
| Abs. pov.: 10\$ per day | 49.3% | 32.4% | 29.1% | 26.1% |

Note: Incomes in real 2005 PPP USD values. Poverty and inequality indexes calculated using SIMPL definition of disposable income per capita income on individual level. Negative incomes have been converted to 0 and included in Gini calculation.

6.2 Estimating counterfactual distributions:

Following the notation of DiNardo et al. (1996) we assume that each observation in the two periods (2005, 2014) belongs to a joint distribution of wages F(w, x, t), where w represents wage, x individual characteristics and t time period. The density of wages conditional on given time is thus equal to:

$$f_t(w) = \int_{x \in \Omega_x} dF(w, x | t_{w,x} = t)$$

with Ω_x being the domain of definition for individual attributes.

This expression can be written as the integral of wages conditional on individual characteristics and time period over the distribution of individual attributes conditional on time:

$$f_t(w) = \int_{x \in \Omega_x} f(w|x, t_w = t) dF(x|t_x = t)$$

To obtain the distribution of wages in 2014 with the distribution of attributes as in 2005 we write:

$$f_t(w; t_w = 14, t_x = 05) = \int f(w|x, t_w = 14) dF(x|t_x = 05)$$

Following DiNardo et al. (1996) we introduce a reweighting function $\psi(x) = dF(x|t_x = 05)/dF(x|t_x = 14)$ such that:

$$f_t(w; t_w = 14, t_x = 05) = \int f(w|x, t_w = 14)\psi(x)dF(x|t_x = 14)$$

Using Bayes' rule we write the reweighting function $\psi(x)$ as:

$$\psi(x) = \frac{\Pr(t_x = 05|x)}{\Pr(t_x = 14|x)} \frac{\Pr(t_x = 14)}{\Pr(t_x = 05)}$$

These probabilities of being observed in time period t_x conditional on individual attributes can be estimated from a probit model where each individual is assigned with 1 when present in 2014 and with 0 if present in 2005 as the dependant variable. Given that each individual is present only once in the data and that we have only two time periods, we can write that $Pr(t_x = 05|x) = 1 - Pr(t_x = 14|x)$ and thus make only one estimation.

By using different characteristics x we can assess how they influenced the wage distribution. We fit two models, where the first model includes age, gender and disability and the second model is extended by adding education level.

The estimated $\widehat{\psi(x)}$ for each individual serve as weights for the kernel density estimates shown on Figure 4 and differences between the actual gross income distribution and modelled estimates for the two specifications on Figure 5⁹.

⁹ To obtain kernel density estimates using probability weights we multiply observation weights by $\widehat{\psi(x)}$.

| | Model 1 | | Model 2 | |
|---|------------|----------|------------|----------|
| Age | 1.954*** | (5.40) | -2.249*** | (-6.00) |
| Age^2 | -2.967*** | (-3.88) | 5.235*** | (6.66) |
| Age^3 | 2.195*** | (4.39) | -2.368*** | (-4.65) |
| Gender (male as base): | | | | |
| female | -0.0274 | (-1.08) | -0.0960*** | (-3.34) |
| Gender # Disability (none as base): | | | | |
| male # severe | -0.0464 | (-1.72) | -0.0154 | (-0.55) |
| male # mild | -0.0807*** | (-3.95) | -0.0564** | (-2.73) |
| male # slight | -0.447*** | (-18.71) | -0.416*** | (-17.36) |
| male # disability statement | -1.381*** | (-4.40) | -1.368*** | (-4.16) |
| female # severe | -0.145*** | (-5.46) | -0.0578* | (-2.13) |
| female # mild | -0.0812*** | (-3.92) | -0.0250 | (-1.20) |
| female # slight | -0.413*** | (-17.57) | -0.332*** | (-14.07) |
| female # disability statement | -1.071*** | (-3.89) | -0.970*** | (-3.58) |
| Gender # education (primary/none as base) | : | | | |
| male # Higher | | | 0.543*** | (31.20) |
| male # Secondary | | | 0.286*** | (20.53) |
| male # Vocational | | | 0.236*** | (17.47) |
| female # Higher | | | 0.734*** | (49.22) |
| female # Secondary | | | 0.292*** | (24.03) |
| female # Vocational | | | 0.326*** | (24.18) |
| Constant | -0.479*** | (-8.69) | -0.140* | (-2.47) |
| Voivodship | Yes | | Yes | |
| Quarter | Yes | | Yes | |
| Observations | 161290 | | 161290 | |
| t statistics in parentheses | | | | |

Table A2. Model of probability of being in the sample for 2014

p < 0.05, p < 0.01, p < 0.001



